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mouth parts in all of the principal genera of bees. There are chapters on the function of the tongue, and on the adaptation of the mouth parts to the flowers visited by the bees. There are many text-figures, and two fine double plates.

THE British Museum (Nat. Hist.) has issued an illustrated guide to the insects exhibited in its halls; evidently prepared by Mr. Waterhouse.⁶ There is a general account of insects, and full treatment of the lower orders. The Coleoptera and Hemiptera are barely mentioned, as the series is not completed in these groups; and of the Diptera only the blood-sucking forms receive attention. A number of the illustrations are photographs of nests of wasps, ants and termites.

MR. M. T. SWENK has given a revision of our species of a part of the large genus of bees—*Colletes*.⁷ He treats of the species which have black hair on the thorax of the female; these are 26 in number. Besides the technical descriptions, which appear very complete, there is much matter on the distribution, flower-habits, etc., of the various species. The three plates illustrate the seventh ventral segment of the male. It is unfortunate that the reprint bears no indication of the journal of which it forms a part.

NATHAN BANKS

SPECIAL ARTICLES

ON A COMMUNICATION BETWEEN THE AIR-BLADDER AND THE EAR IN CERTAIN SPINY-RAYED FISHES

A CONNECTION between the air-bladder and the ear in spiny-rayed fishes has been touched upon from time to time since Weber described the elaborate connection between these organs in the Osteriophysi (cat-fishes, minnows, etc.) brought about by the chain of ossicles which bears his name. In the spiny-rayed fishes, however, this connection has usually been through the apposition of the air-bladder to a

cartilaginous wall where certain of the lateral cranial bones have failed to come together to complete the bony wall of the lower part of the pterotic capsule. The perilymph which bathes the inner surface of the cartilaginous wall and the auditory organs completes the communication. Such is the case in *Lotella*¹ and in *Myripristis*.

Recently I have found in *Nematistius pectoralis* a more highly specialized connection between the ear and the air-bladder than has been noticed before among the spiny-rayed fishes; the connection in this case being brought about through a long tunnel actually penetrating the basioccipital bone and being confined to that bone at its lower end.

In *Myripristis* (*M. occidentalis*) the lower part of the pterotic capsule is separated off as a special sacculus or otolith chamber in the outer wall of which is a large cartilaginous area between the prootic in front, the basioccipital below and the exoccipital above and behind. To this cartilage a large prolongation from the air-bladder is broadly attached.

In *Holocentrus* (*H. ascensionis*) this condition is somewhat modified. On the side of the cranium the otolith chamber forms an elongate and tube-like prominence, which is extended backwards to the side of the occipital condyle, where it opens widely through a symmetrical, round, smooth aperture. The side of the otolith chamber is mostly formed by the prootic prolonged backwards, though the exoccipital above and the basioccipital below assist materially.² The length of the chamber is nearly filled by a very large otolith. This posterior opening, though obviously of a more highly specialized character than in *Myripristis*, still occurs between the same bones. It apparently has no cartilaginous covering homologous with the cartilaginous lateral area in *Myripristis*, but the thin inner membrane of the air-bladder forms a sort of a loose

¹ Reported on by T. J. Parker, *Trans. N. Zeal. Inst.*, 1882, Vol. 15, p. 234.

² For a picture of the cranium of *Holocentrus ascensionis* showing the exterior of the otolith chamber see "The Osteology of Some Berycoid Fishes," Starks, *Proc. U. S. Nat. Mus.*, Vol. XXVII., p. 611.

⁶ "A Guide to the Exhibited Series of Insects," with 62 illustrations, 57 pages, London, 1908.

⁷ "Specific Characters in the Bee Genus, *Colletes*," pp. 43-102, 3 pls., 1908; University of Nebraska, Contrib. Dept. Entom., No. 1.

tympanum over it, while the thicker, more fibrous, outer membrane is attached to the bone around the mouth of the opening. The air-bladder is further anchored anteriorly by a stout Y-shaped ligament firmly attached to the basioccipital. The otolith chamber opens above into the brain chamber at about the middle of its length by a rather small (as compared with other fishes) foramen through which the sacculus communicates with the utricle and the other auditory elements.

Peculiarly *Holocentrus suborbitalis* Gill, a hitherto supposedly closely related species, has no posterior opening from the otolith chamber, the chamber does not form a tube-like prominence at the side of the cranium, the otolith is comparatively small, and the air-bladder does not extend forward to the cranium. These characters seem of sufficient importance to make *suborbitalis* the type of a distinct genus, for which the name *Adioryx* is proposed.

In a prepared dry cranium of *Nematistius* there appears no long tube-like otolith chamber at the side of the cranium, but at each side and just below the occipital condyle there is a sudden bulging of the basioccipital bone containing the wide-open mouth of a long tunnel leading upward to the brain chamber, and opening into the latter in the same way and at the same place that the otolith chamber of *H. ascensionis* opens into it. In a dissection prepared from an alcoholic specimen a small otolith is found in the upper end of the tunnel. Into the lower part of the tunnel the air-bladder projects, lining it with a delicate membrane; and near the middle of the tunnel, at its narrowest part, the air-bladder closes it, thus forming a delicate membranous pocket.

The auditory connection in the case of *Nematistius*, where a special tunnel is opened through the bone to accommodate it, is obviously of a deeper-seated nature than in any of the other examples where advantage is taken of interossified areas even though these areas have become somewhat specialized. The small taxonomic value of the connection of the air-bladder to the ear is illustrated in *Adioryx* and *Holocentrus*, where in one case the connection is absent while in the other it is

present and with the cranial bones modified to accommodate it. It can probably be used only in showing relationship between species or genera at the most. The condition as it exists in *Nematistius* may prove of greater value in this respect.

EDWIN CHAPIN STARKS

A NEW SOIL SAMPLER

A LABORATORY study of the physical characteristics of soils has come to be considered of primary importance in soil investigations. Much has been done within recent years toward studying soils from this standpoint with air-dried samples. Comparatively few attempts, however, have been made to study samples which possessed the texture, structure, moisture content and other features found under field conditions. For many reasons, investigators can not materially add to our knowledge as long as data are secured only from air-dried samples. Real progress in research can begin only with the use of apparatus designed to take samples of adequate volume and of such character as will enable the investigator to deal in the laboratory with samples which possess essentially the same physical properties as are possessed by the soils in the field.

Many devices and methods have been introduced for soil sampling.¹ For general physical and chemical analytical work the standard methods of sampling are all essentially the same and each of them has proven more or less satisfactory for the purpose for which it was devised.

However, with one or two exceptions none of the methods of sampling which have thus far been introduced makes it possible to bring to the laboratory a sample of soil in the condition in which it rested in the field.

In the method of sampling proposed by the investigators at Rothamsted, a steel or brass frame, fitted with a keen cutting edge and open at top and bottom is driven into the soil by repeated blows with a wooden or iron

¹ See Wiley's "Principles and Practice of Agricultural Analysis," Vol. I., pp. 61-85, for a discussion of methods for sampling soils. See, also, Hall's "The Soil," pp. 45-48.